SYMMETRIES IN FIELD THEORIES: REDUCTION

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The geometric formulation of Mechanics and Field theories has proved to be a powerful bridge between Theoretical Physics and Differential Geometry with fascinating results in each side inspired from the other. In particular, both the Hamiltonian and Lagrangian frameworks of this interplay have made intensive use of the notion of symmetry. This is intimately related with the reduction of the configuration manifold by the action of a Lie group. Central results (Marsden, Weinstein, Ratiu...) focus on this topic. In this talk we will explore this panorama, with special emphasis in the version for classical Field Theories, from the classical setting to the last results when the nature of the symmetry is gauge (that is, the symmeties are defined by a Lie group bundle acting fiberwisely). This will give a new understading of the Yang-Mills Lagrangian as well as a reinterpretation of strong results as Utiyama theorem.

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